Your full name:

Your personnummer (Swedish ID number), yymmdd-xxxx:

Instructions

- The exam consists of 36 statements, of which 18 are true (correct) and 18 are false (wrong). Your task is to mark the true statements.
- The 36 statements are divided into groups, where each group has some background information that is common to all the statements in the group.
- You will be given 95 minutes (no break) to complete the exam.
- Your exam score is calculated as follows. True statements that you mark as true are awarded 1 point, and false statements that you mark as true give 1 point deduction. Statements that you do not mark never give any points, positive or negative.
- The maximum score is +18 and the minimum is −18. You must be awarded at least +6 points to pass the exam. Your exam score contributes directly to your total course score that is used to calculate your grade on the course (i.e., the exam contributes at most 18 points to your course score).
- You may only use a pen or pencil and an eraser. Specifically, no electronic equipment, no books, and no notes are allowed.
- Feel free to make notes or calculations on the form or on the provided extra paper.

The form will be read by a machine. Please mark clearly with a pen or pencil.
Check: ☒
Uncheck to correct: ■

1

Consider a symmetric two-player game with the following payoff matrix:

$$\begin{bmatrix} 3 & 0 \\ 1 & 1 \end{bmatrix}$$

1.1 Mark the true statements.

- ☐ The game has exactly three Nash equilibria.
- ☐ The game has exactly two Nash equilibria.
- ☐ There are exactly two Pareto optimal strategy profiles.
- ☐ There are exactly four action profiles in this game.
- ☐ There are infinitely many mixed strategy profiles in this game.

2

Consider the infinitely repeated game with average payoffs and single-round payoff matrix as in Question 1 above.

2.1 Mark the true statements.

- ☐ There is a strategy profile for the repeated game that has average payoff profile $(2,\ 2)$ and is a Nash equilibrium.
- ☐ There is a strategy profile for the repeated game that has average payoff profile $(1/2,\ 1/2)$ and is a Nash equilibrium.
- ☐ There is a strategy profile for the repeated game that has average payoff profile $(3,\ 2)$ and is a Nash equilibrium.

3

Consider a symmetric 2-player game with n actions. Assume that the choice of actions is simultaneous, i.e., the two players do not know the other player's action when choosing.

3.1 Mark the true statements.

☐ Each player has exactly n^2 possible strategies.
☐ There must be at least one pure strategy Nash equilibrium.
☐ There must be infinitely many mixed strategy Nash equilibria.
☐ There must be at least one evolutionarily stable strategy (in the strict sense).
☐ The number of Pareto optimal strategy profiles must be larger than the number of Nash equilibria.
☐ The game can be written in extensive form.

4

Consider a two-player game with the following payoff matrix:

		Player 2	
		C	D
Player 1	A	(30, 70)	(50, 50)
	B	(80, 20)	(−100, 200)

4.1 Mark the true statements.

☐ All strategy profiles that are Nash equilibria for this game are also Pareto optimal.
☐ This game has at least one pure strategy Nash equilibrium.
☐ This game has at least one mixed strategy Nash equilibrium.
☐ One Nash equilibrium is the strategy profile where Player 1 plays action A with probability $p = \frac{9}{10}$ and Player 2 plays action C with probability $q = \frac{3}{4}$.
☐ One Nash equilibrium is the strategy profile where Player 1 plays action A with probability $p = \frac{9}{10}$ and Player 2 plays action C with probability $q = \frac{1}{2}$.
☐ One Pareto optimal strategy profile is where Player 1 plays action A with probability $p = \frac{9}{10}$ and Player 2 plays action C with probability $q = \frac{1}{2}$.

5

Consider a population playing the rock-paper-scissors game with payoff matrix as follows:

	R	P	S
R	(0, 0)	(−1, 1)	(1, − 1)
P	(1, − 1)	(0, 0)	(−1, 1)
S	(−1, 1)	(1, − 1)	(0, 0)

One strategy M in this game is the mixed one with uniform probability 1/3 over all three actions.

5.1 Mark the true statements.

- ☐ The mixed strategy M is evolutionarily stable (in the strict sense).
- ☐ The strategy profile (M, M) is a Nash equilibrium.
- ☐ There are two or more Nash equilibria in this game.

6

		Player 2				
		E	F	G	H	I
Player 1	A	(8, 1)	(1, 3)	(8, 0)	(5, 0)	(1, 1)
	B	(2, 1)	(0, 2)	(2, 1)	(3, 3)	(3, 0)
	C	(4, 1)	(0, 4)	(5, 1)	(3, 0)	(1, 2)
	D	(8, 1)	(0, 1)	(8, 0)	(4, 2)	(0, 3)

6.1 Mark the true statements.

- ☐ This game has no pure strategy Nash equilibrium.
- ☐ This game has exactly one pure strategy Nash equilibrium.
- ☐ This game has multiple pure strategy Nash equilibria.
- ☐ The pure strategy where Player 1 plays action D is strictly dominated.
- ☐ The pure strategy where Player 2 plays action E is strictly dominated.
- ☐ The pure strategy where Player 2 plays action G is strictly dominated.

7

Consider the following sequential game between two players.

In the first round player one receives a gold coin that she can decide to keep, and then the game is finished with payoff profile $(1,\ 0)$.

She may instead choose to let the game continue by passing the coin to the second player, and in that process the payoff to consider doubles so that there are now two coins for the second player to take a decision on. He may decide to keep the coins, then finishing the game with payoff profile $(0,\ 2)$, or he may also decide to let the game continue, giving back the coins to the first player so that there are 4 coins to consider in the third round, etc.

The game is played a maximum of 10 rounds, and in the 10th round the second player has no choice but just keeps the 2^9 coins that he was given while the first player gets 0. Thus, the payoff profile in this case is $(0,\ 512)$.

Let S^* be a mixed strategy profile where both players always hand over the coins to the other player, except in their last choices, i.e., rounds 8 and 9, where both players randomly decide to keep the coins with probability 1/2.

7.1 Mark the true statements.

- ☐ All Nash equilibria are characterized by payoff profile $(1,\ 0)$.
- ☐ There is at least one strategy profile which is a subgame perfect Nash equilibrium and has the following properties: Player one decides to keep the coins in the first round. Player two decides to pass the coins in the second round (if he gets the chance), but keeps the coins in the fourth round (if the chance is given).
- ☐ The strategy profile S^* (described above) has payoff profile $(64,\ 192)$.
- ☐ This game can be represented in extensive form.
- ☐ This game can be represented in strategic form.
- ☐ There is only one Pareto optimal pure strategy profile.
- ☐ This is a game of perfect information.